

# Biodiversity and bioecology of Iraqi desert truffles (Pezizaceae) during season 2014

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## ABSTRACT

Desert truffles were a mystery to the ancient world of the Greeks and Romans, but this did not prevent their culinary enjoyment and knowledge of several varieties from various locations. The hypogeous ascomycetes (desert truffles) were collected and identified from Hit market western Iraq with its prices and environment. In general, two genera were observed, viz., *Terfezia* sp. and *Tirmania* sp. Locally, *Terfezia* sp. called in Arabic "ahraq" or "jaba," whereas *Tirmania* sp. called "zubaidi" or "sheikh" or "shiuokh." These truffles live in mycorrhizal association with *Helianthemum* sp. or without any mycorrhizal association. Desert truffles appeared from last January to beginning of March 2014 in this Iraqi market. Its prices started from 65,000 IQD/kg (around 52 USD/kg) then declined when high amounts of truffles are coming into the market. Two factors, rainfall and exportation, effect on desert truffles prices. Some of amounts were exported to Baghdad or other places (in side), or Jordan (outside), thus that led to increasing its prices, and the reverse is true.

**KEY WORDS:** Economic, *Helianthemum* sp., *Terfezia* sp., *Tirmania* sp., symbiotic fungi

## INTRODUCTION

Desert truffles were a mystery to the ancient world of the Greeks and Romans, but this did not prevent their culinary enjoyment and knowledge of several varieties from various locations (Iddison, 2011). Desert truffles such as *Picoa* sp., *Terfezia* sp., *Tirmania* sp., and *Tuber* sp. were used to refer to edible hypogeous fungi (fungi that live entirely underground), family Pezizaceae, which grow in arid and semi-arid areas of the Mediterranean region (Rodriguez, 2008). On a subsequent posting to Iraq, Iddison (Iddison, 2011) encountered them for sale in Baghdad in the autumn; the Iraqi name is kamaa, kima, or chima in some local dialects. They were a seasonal luxury food in Iraq.

In Saudi Arabia, dessert truffles appeared in the markets from November to December and supply is dependent on the amount of rainfall as in other countries (Iddison, 2011). Both respondent groups agree that heavy rains around >200 mm during mild to warm weather, locally recognized as Al-Wasm, coupled with heavy evening or early morning dew falls and thunder and lightning are considered essential requirements for desert truffles formation (Mandeel and Al-Laith, 2008).

Desert truffles used both for food and traditional medicine (Dogan *et al.*, 2007). *Terfezia* sp. has nutritional value due to proteins, carbohydrates, low fat, ascorbic acid, crude fibers (Rodriguez, 2008), magnesium, energy about 34.00-65.00 (kcal/100 g) (Dundar *et al.*, 2012), phenols, carotenoids, and anthocyanin (Gouzi *et al.*, 2013). Desert truffles have very high amounts of antioxidants (Rodriguez 2008), thus has antiradical properties (Gouzi *et al.*, 2013) and antimicrobial activity (Janakat *et al.*, 2004; Gouzi *et al.*, 2011; Dogan and Aydin, 2013; Dogan *et al.*, 2013). Furthermore, *Terfezia* found active at least against plant pathogenic fungi (Paul *et al.*, 2008); thus, it was used as a pharmaceutical agent.

Wild edible fungi are collected for food and to earn money in more than 80 countries (Ammarellou *et al.*, 2007). In Iraq, Anbar desert is rich with truffles (Al-Rawi and Taha, 2010). Eastern Turkey also has truffle species, which appear in local markets of Gaziantep city in May, about 320 pence a kilo (Iddison, 2011). The only specimens seen to date in Al Ain were imported Tunisian truffles in local supermarkets. Again climatic conditions have to be ideal for a significant local crop, and this is being diminished by the reduction in extent and damage to the

desert environment. Prices of £40-60 per kilo are quoted (Iddison, 2011).

In this research, I will aim to investigate the changes in varieties, biodiversity, ecology, climate, and other data of desert truffles in Iraq. No recent data about Iraqi truffles, thus this paper was an achievement for identification desert truffles and evaluation its prices in Iraqi market during season 2014.

## MATERIALS AND METHODS

### Data and Samples Collection

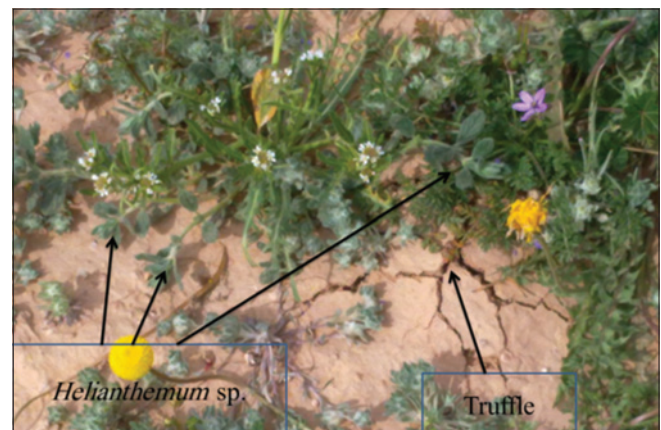
Data of desert truffles were collected from the desert of Anbar and main market of Hit, west of Iraq. Prices of truffles evaluated in this market from the end of January until the start of March 2014. Images of truffles were captured in some cities Nukhayb and Hit in Anbar province on 2014.

Genera of desert truffles were collected from Hit market during the end of winter season 2014. Standard methods of collection and identification were followed on genus level according to (Alsheikh, 1994; Ammarellou *et al.*, 2007; Kagan-Zur *et al.*, 2014) which used for identification of desert truffles, depending on their taxonomic keys.

## RESULTS AND DISCUSSION

Desert truffles appeared in Hit market (Iraq) on 24 January 2014. This market considers as a central market for selling truffles. Prices started from 65,000 IQD/kg (52 USD/kg) for fruits which weighted  $\geq 100$  g then declined to 35,000 IQD/kg (28 USD/kg), reached to 25,000 IQD/kg (20 USD/kg) when more quantities come into markets. Small sizes of truffles ascocarps were sold about 15 IQD/kg (12 USD/kg). Figures 1 and 2 showed two genera in this market *Terfezia* sp. and *Tirmania* sp., especially Hit market of vegetables contains streaky amounts of truffles from the end of January to end of February or beginning March from each year if it founds. Truffles come from the desert of western (Anbar), northern (Mosul), and southern (Samawah capital of Al Muthanna) of Iraq. The best various come from western Iraq (Nukhayb town). The price increased when big amounts of desert truffles exported to Baghdad (inside) or Jordan (outside) as said by salespersons. Wet autumns favored a heavy crop, and conversely a dry autumn induced a scarcity which sent prices rocketing as they are highly esteemed (Iddison, 2011).

Some salespersons in Iraq depended on size and/or variety of truffles in selling (Figures 1 and 2). The higher price was reported with *Terfezia* sp. (locally called in Arabic “ahraq” or “jaba”) that gray to brown or black truffles, followed *Tirmania* sp. (“zubaidi” or “sheikh” or “shiuokh”) that white. In Iraq, some peoples prefer purchasing *Terfezia* sp. opposite *Tirmania* sp. due to roughly fruiting bodies of *Tirmania* sp. which contain some sands in its cleavages. Furthermore, *Terfezia* sp. is highly appreciated in many countries such as countries of Arab Gulf and Iraq because of their special taste and smell (Mello *et al.*, 2006). In general, *Terfezia* sp. and *Tirmania* sp. are common in Iraqi market may be due to their unique flavor by volatiles which may be affecting by ecological factors (Splivallo *et al.*, 2006). However, in Bahrain, *Tirmania nivea* “Zubaidi” was found to be the most preferred expensive and common type of truffle in the region to both groups of respondents due to its good light smell, delicacy, and soft white tissues. This was followed by *Terfezia clavaryi* “Ikhlas” (Mandeel and Al-Laith 2008).



**Figure 1:** *Helianthemum* sp. associated with desert truffles in a Nukhayb town



**Figure 2:** Main market of vegetables and fruits in Hit, February 2014

Fuga (faga) is a term for the first appearance for desert truffle in soil, and this name is common in Iraqi local dialect (Figure 1). Truffles normally harvested during mid-winter and early spring on half of January 2014 in Nukhayb town first, until March from this year. That agrees within Iran, particularly from January to March (Ammarellou *et al.*, 2007). However, it appeared in the Kuwaiti suq from November to January according to the progression of the season (Iddison, 2011).

These fungi develop underground in the desert. They are usually found in close proximity to plant, *Helianthemum* sp. (Cistaceae) with which they appear to have a symbiotic relationship as shown in Figure 1 that agrees with recorded by Navarro-Ródenas *et al.* (2009), who suggested that the ascocarp of *T. claveryi*, at some stages of its development, may become nutritionally autonomous and independent of the host plant. These hypogeous ascomycetes live in mycorrhizal association with *Helianthemum lippii* (Bradai *et al.*, 2014). Moreover, stress induced a change in the mycorrhizal type formed, which was more intracellular under drought stress for *H. almeriense* with *Terfezia claveryi* (Navarro-Ródenas *et al.*, 2013).

Furthermore, desert truffles found without mycorrhizal association with *Helianthemum* sp. *T. claveryi* exhibited a mycelium growth pattern characteristic of drought tolerant species. The increased alkaline phosphatase (ALP) activity observed in desert truffle at moderate water stress with respect to the control indicated the functional adaptation of these mycelia to these drought conditions. ALP activity can be used as an indicator of the metabolic activity of these fungi. Slight water stress could improve mycelial inoculum production of these desert truffles (Navarro-Ródenas *et al.*, 2011).

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## REFERENCES

- Al-Rawi AA, Taha AM. Chemical study for three Iraqi truffles types. *Al-Anbar J Agric Sci* 2010;8:33-41.
- Alsheikh AM. Taxonomy and Mycorrhizal Ecology of the Desert Truffles in the Genus *Terfezia*. Ph.D. Dissertation, Oregon State University, Corvallis; 1994. p. 239.
- Ammarellou A, Saremi H, Guzin F. Evaluation of morphology, cytology and mycorrhizal relationships of desert truffles (*Terfezia boudieri*) in Iran. *Pak J Biol Sci* 2007;10:1486-90.
- Bradai L, Bissati S, Chenchuni H. Desert truffles of the North Algerian Sahara: Diversity and bioecology. *Emirates J Food Agric* 2014;26:425-35.
- Dogan HH, Aydin S. Determination of antimicrobial effect, antioxidant activity and phenolic contents of desert truffle in Turkey. *Afr J Tradit Complement Altern Med* 2013;10:52-8.
- Dogan HH, Duman R, Özkalp B, Aydin S. Antimicrobial activities of some mushrooms in Turkey. *Pharm Biol* 2013;51:707-11.
- Dundar A, Faruk Yesil O, Acay H, Okumus V, Ozdemir S, Yildiz A. Antioxidant properties, chemical composition and nutritional value of *Terfezia boudieri* (Chatin) from Turkey. *Food Sci Technol Int* 2012;18:317-28.
- Gouzi H, Belyagoubi L, Abdelali KN, Khelifi A. *In vitro* antibacterial activities of aqueous extracts from Algerian Desert truffles (*Terfezia* and *Tirmania*, Ascomycetes) against *Pseudomonas aeruginosa* and *Staphylococcus aureus*. *Int J Med Mushrooms* 2011;13:553-8.
- Gouzi H, Leboukh M, Bouchouka E. Antioxidant and antiradical properties of methanolic extracts from algerian wild edible desert truffles (*Terfezia* and *Tirmania*, Ascomycetes). *Int J Med Mushrooms* 2013;15:471-86.
- Iddison P. Truffles in Middle Eastern Cookery. Emirates Natural History Group, (Patron: H. E. Sheikh Nahayan bin Mubarak Al Nahayan); 2011. Available from: <http://www.enhg.org/alain/phil/truffle/truffle.htm>. [Last accessed on 2015 Oct 19].
- Janakat S, Al-Fakhri S, Sallal AK. A promising peptide antibiotic from *Terfezia claveryi* aqueous extract against *Staphylococcus aureus* *in vitro*. *Phytother Res* 2004;18:810-3.
- Kagan-Zur V, Roth-Bejerano N, Sitrit Y, Morte A. Desert Truffles: Phylogeny, Physiology, Distribution and Domestication. New York: Springer, Berlin Heidelberg; 2014. p. 397.
- Mandeel QA, Al-Laith AA. Ethnomycological aspects of the desert truffle among native Bahraini and non-Bahraini peoples of the Kingdom of Bahrain. *J Ethnopharmacol* 2007;110:118-29.
- Mello A, Murat C, Bonfante P. Truffles: Much more than a prized and local fungal delicacy. *FEMS Microbiol Lett* 2006;260:1-8.
- Navarro-Ródenas A, Bárzana G, Nicolás E, Carra A, Schubert A, Morte A. Expression analysis of aquaporins from desert truffle mycorrhizal symbiosis reveals a fine-tuned regulation under drought. *Mol Plant Microbe Interact* 2013;26:1068-78.
- Navarro-Ródenas A, Lozano-Carrillo MC, Pérez-Gilabert M, Morte A. Effect of water stress on *in vitro* mycelium cultures of two mycorrhizal desert truffles. *Mycorrhiza* 2011;21:247-53.

- Navarro-Ródenas A, Morte A, Pérez-Gilabert M. Partial purification, characterisation and histochemical localisation of alkaline phosphatase from ascocarps of the edible desert truffle *Terfezia clavayi* Chatin. Plant Biol (Stuttg) 2009;11:678-85.
- Paul NC, Kim WK, Woo SK, Park MS, Yu SH. Diversity of endophytic fungi associated with *Taraxacum coreanum* and their antifungal activity. Mycobiology 2006;34:185-90.
- Rodriguez A. Desert Truffles. Trufamania; 2008. Available from: <http://www.trufamania.com/desert-truffles.htm>. [Last accessed on 2015 Oct 19].
- Splivallo R, Ottonello S, Mello A, Karlovsky P. Truffle volatiles: From chemical ecology to aroma biosynthesis. New Phytol 2011;189:688-99.